## **Horizons**

**S&P Global** Energy



## Horizons Top Trends 2026

Al growth and geoeconomic shifts in cleantech markets confirm that energy expansion and sustainability are linked imperatives

10 December 2025

## Credits

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Profound geopolitical shifts and strategic repositioning in complex, interconnected energy and sustainability ecosystems will shape energy markets in 2026.

The US is charting its own course, driven by rapid AI growth and evolving energy priorities. Europe is working to reconcile diverse objectives, while China consolidates its cleantech leadership and seeks to draw global markets closer.

Al's explosive power demand is testing grid limits, revenue models and sustainability goals. The pace of progress will depend on unlocking new capacity and flexibility, with grid modernization a key constraint on energy security and competitiveness.

Geopolitical alignment is reshaping the trajectories of renewables, hydrogen, sustainable aviation fuel (SAF), electric vehicles and climate policy, with supply chain and carbon accounting battles intensifying. China's dominance in clean energy supply and technology is growing, while Europe and the US navigate policy swings and market volatility.

Mounting physical and financial climate risks are turning adaptation from optional to essential. The interplay of these trends — Al-driven demand, grid bottlenecks, evolving procurement strategies, scaling technologies for hard-to-abate sectors, disjointed carbon rules, rising costs of climate risk and the urgent need for resilience — highlights how energy expansion and sustainability are not parallel ambitions, but intertwined imperatives shaping the global energy future.



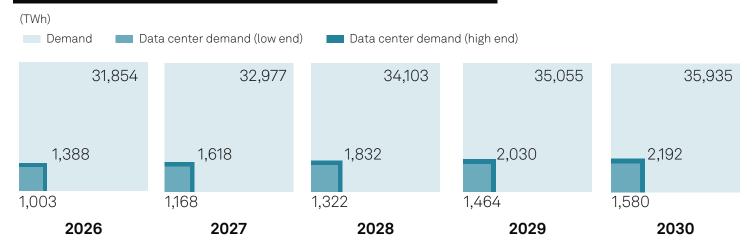


## As AI uptake soars in 2026, energy supply and sustainability commitments face a breaking point

Access to sufficient energy is a critical enabler of a transition to an economy supercharged by AI. Energy may be the gating factor that will determine countries' speed of progress and, by extension, their geoeconomic competitiveness. S&P Global

Energy's high-growth view shows global data center power demand increasing 17% to 2026 and 14% per year through 2030, reaching potential demand of over 2,200 TWh, roughly equivalent to India's current total electricity consumption.

## Projected global data center power demand vs. total generation



As of September 2025.

Source: S&P Global Energy, 451 Research

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Although uncertainties around the magnitude of growth are considerable, expansion at this rate — or anything approaching it — will reverberate across the economy, influencing infrastructure planning, investment flows and national policy, as well as raising environmental concerns. The year 2026 will increasingly shine a spotlight on whether the industry can maintain rapid growth while balancing the sustainability side of the equation. Economics and speed to market will remain key determinants of data center power supply choice, particularly where there are options in supply, and those two top priorities will not always align with sustainability goals.

Data center sustainability commitments vary significantly, and net-zero ambitions are not a given. Data from the 2024 S&P Global Corporate Sustainability Assessment (CSA) shows that 38% of assessed companies with data center operations lack a net-zero commitment.

Major tech firms have made net-zero commitments, including companies leading the AI charge such as Microsoft Corp., Alphabet Inc. and Meta Platforms Inc. However,

\$500B

Spending on US data centers

nears \$500 billion in 2026

meeting those commitments is getting harder, as is being acknowledged in the most recent company sustainability reports. Data center companies have been leading clean power procurement efforts to meet their power needs and climate ambitions, and we look for these to continue, although the pace of new near-term power purchase agreement uptake has been slowing. In 2026, we could see the start of revisions to existing targets and some fracturing of policies by key players and regions.



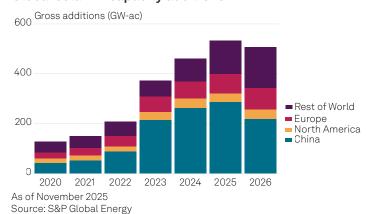


## Solar peaks (for now): First annual slowdown in renewables additions in 2026

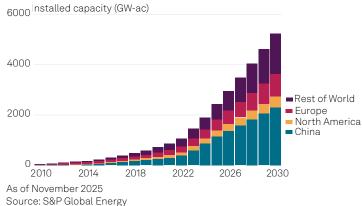
The end of 2025 will mark a high point for renewables installations. By this time, the global solar market will have reached an extraordinary milestone, with installations surpassing 500 GW AC —

an achievement unimaginable when the industry was in single-digit gigawatts just over a decade ago. This surge has been driven largely by China, which accounts for more than half of global additions.

## Global solar PV capacity additions



Global solar PV installed capacity to 2030



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Our analysts now forecast that China's annual additions will fall from approximately 300 GW in 2025 to about 200 GW in 2026, a decline so steep that no other region will be able to compensate. A major policy shift in mid-2025 — from guaranteed pricing to competitive bidding — triggered a dramatic slowdown after an initial rush of installations. This led to a sharp drop in Chinese volumes in the second half of the year, creating intense price pressure and ultra-thin margins across the supply chain

This anticipated contraction marks a turning point. For the first time ever, global solar additions are expected to decline year over year, albeit by less than 10%.

While this signals the end of uninterrupted growth, it does not imply stagnation. Over the next five years, cumulative photovoltaic capacity will still double, supported by emerging markets, diversification into storage and innovation in operations and maintenance. The industry faces a new dynamic — growth without the guarantee of ever-increasing annual volumes — forcing consolidation and strategic shifts. But low module prices and solar's inherent scalability will continue to unlock new markets.

10% decline

For the first time ever,

global solar additions are expected

to decline year over year,

albeit by less than 10%.

Such a prediction comes with caution. Analysts have systematically under-called the solar market for many years. Policy changes can alter the outlook significantly and suddenly, and market elasticity continues to surprise. Whether the market declines or not, what is significant is our arrival at the point where we can start talking about a peak in global demand growth.

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## Grid infrastructure key

## Grid modernization becomes a key constraint in energy security, transition and competitiveness

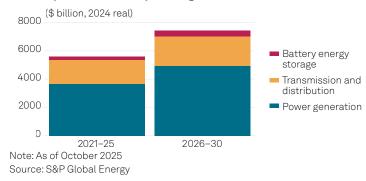
In 2026, grid infrastructure moves center stage. For decades, grid investment has lagged the pace of energy decarbonization and energy innovation across many markets. This underinvestment has now become a critical bottleneck. As the world races to address expanding energy needs — electrification, decarbonization and digitalization — the grid must evolve or risk becoming the weakest link in power systems.

Power sector decarbonization in the EU — where 40% of EU grids are over 40 years old and built for a fossil fuel era — requires increasing investment in grid infrastructure to improve reliability and reduce dependence on gas. The European Commission estimates that €584 billion in grid capital expenditure is needed by 2030, rising to €1.2 trillion by 2040. Yet, permitting delays — averaging 12 to 17 years for new

transmission lines — and the lack of dedicated investment vehicles make upgrading existing mid- and high-voltage infrastructure a more viable near-term solution.

The US faces its own grid challenges. Explosive data center growth and power needs, driven by AI and cloud computing, are straining local and obsolete grids. Without urgent investment and smarter planning, the US risks a capacity crunch and even grid instability. Across the industry, calls are mounting — from hyperscalers to utilities and policymakers — to tackle structural roadblocks to power infrastructure buildout. Proposals range from expanding tax credits to streamlining permitting and accelerating component manufacturing, signaling a shared recognition that grid modernization is now a national competitiveness issue.

## Global power sector spending



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The grid is no longer just enabling infrastructure. It is critical infrastructure. For policymakers, utilities and investors, the message is clear: The energy expansion required to satisfy AI-driven demand growth will only move as fast as the grid allows.

The energy expansion required to satisfy AI-driven demand growth will only move as fast as the grid allows.

## Grid modernization trends

## What's Emerging in 2026? - Emerging technologies/solutions



## **Grid-forming inverters**

Grid-forming inverters are gaining traction, enabling renewables and storage to provide critical grid stability services.



## AI-driven digitalization

Al-driven digitalization is optimizing grid operations, forecasting, and real time management of distributed energy resources.



### VPPs and DER

Virtual Power Plants and Distributed Energy Resources reach the next level of maturity and software sophistication.



## Existing renewable assets

Existing renewable assets for grid services to provide frequency regulation and balancing services.



## Solid state transformer

SSTs shift from R&D to early deployment by 2026, targeting EV fast charging and Al datacenters.



## Grid enhancing technologies

GETs remain key to unlock capacity and optimize existing infrastructure.



## Storage capacity

Storage capacity is accelerating, with new tenders focused on standalone and co-located battery projects with renewables.





## Onsite generation

Onsite generation is rising, especially around data centers, to reduce grid dependency and improve reliability.



## Cybersecurity

Cybersecurity is now a core pillar of grid resilience, as digital threats grow alongside physical ones.





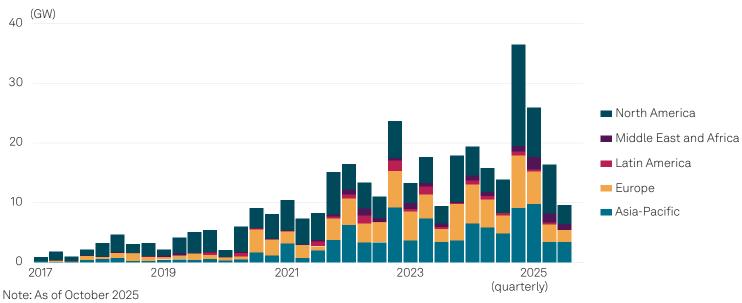
## Flexible PPAs become the new standard as price volatility reshapes risk management

Increasing renewable capacity — especially solar PV — is leading to more zero- and negatively priced settlements in wholesale markets. This volatility is forcing a rethink in commercial structures: The market is moving from plain PPAs to flexibility-backed hedges, with hybrid PPAs combining multiple technologies and storage, to manage risk and monetize flexibility.

For now, the market is in a "brainstorming" phase: Utilities and energy companies are early adopters of structured and flexibility products, while corporates and renewable developers are still catching up and often rely on simpler structures with less-nuanced risk allocation. A shift toward shorter contract terms and stronger downside protections could follow as capture rates deteriorate.

Extreme price swings are most visible in Europe, where Platts, part of S&P Global Energy, reports that PPA price indexes in Spain and Germany remain well below solar PV cost-based levels. Platts also notes wide spreads between buyer and seller expectations, reflecting changing perspectives amid rising risks of declining capture ratios and increasing zero and negative prices.

## Regional corporate clean energy PPA deals announced



Source: S&P Global Energy, Corporate Renewables Contracts

S&P Global Energy Horizons Hybrid PPAs rise Horizons Top Trends 2026 December 2025

Meanwhile, standalone and co-located battery energy storage systems (BESS) deals are rising, with strong growth underpinned by additions expected through 2026 in the US (Texas, California ), Europe (Germany, UK) and Australia. The US will be installing almost 15 GW of new BESS capacity in 2026, with Germany and Australia following with 5 GW, and the UK with 3 GW.

In an environment of slowing sustainability commitments and uncertainties tied to greenhouse gas Scope 2 protocol guidance revisions, we are seeing fewer announced clean energy procurements, with S&P Global Energy's Corporate Renewables Contracts database showing that global corporate PPA activity has slowed.

After a strong start to the year, third-quarter 2025 activity has touched a multiyear low across the globe, with only 9.5 GW in announced deals, compared with 13.9 GW in third quarter 2024. However, data centers have continued to procure clean power

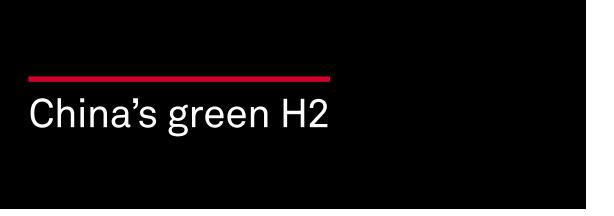
at the same level as in 2024, with 27 GW of PPAs announced through October 2025, accounting for over 43% of the total PPAs, compared with 36% in 2024. They remain the largest PPA offtakers globally in 2025, a trend expected to continue.

## Regional corporate clean energy PPA deals announced



Source: S&P Global Energy, Corporate Renewables Contracts





## As the rest of the world slows down, China gets serious about green hydrogen

In 2026 and beyond, one question looms: Will China export technology, molecules or both?

Hydrogen has been presented as the leading "green molecule" needed to decarbonize hard-to-abate sectors. However, even as global uptake has fallen short of ambitious expectations, China has emerged as the global leader in electrolytic ("green") hydrogen, with domestic deployment and exports set to grow exponentially in 2026. Green hydrogen is central to China's plan to dominate clean energy supply chains, mirroring its approach in solar and batteries.

Policy support (including mentions in the 14th and 15th Five-Year Plans), regulatory changes and supply-side engineering have laid the foundation for rapid growth. This began to materialize in 2025: Chinese projects will install about 1.5 GW of electrolyzers in the year, nearly doubling the 1.7 GW total installed globally at the end of 2024. Almost 10 GW is under construction, and deployment is projected to reach 4.5 GW in 2026 and 6.9 GW in 2027, expanding global electrolysis capacity eightfold in just three years.

Companies have piled in, creating over 50 GW per year of stated manufacturing capacity. Oversupply is driving fierce competition and steep price declines: Electrolyzer stack prices have plunged from \$250/kW in early 2024 to under \$100/kW, with similar

system cost reductions. Chinese suppliers are also ramping up exports, with projects in Central Asia, Africa, South America and the Middle East procuring Chinese equipment over the past 18 months.

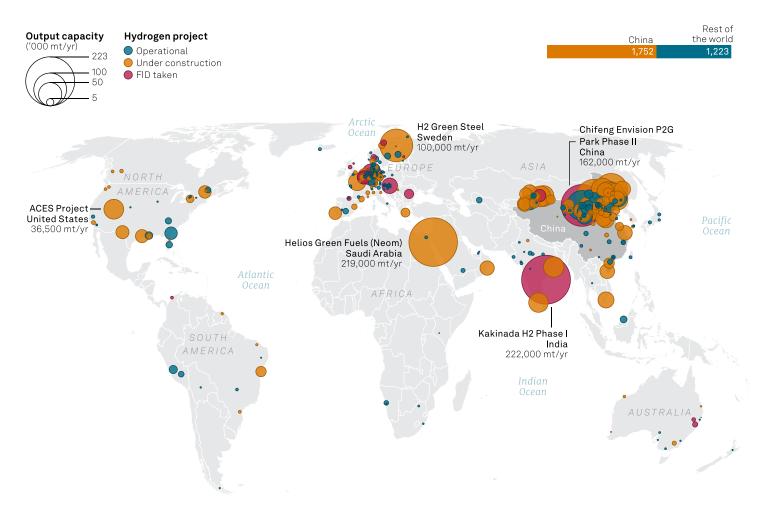
Chinese firms aim to export energy as well as technology. At least two green ammonia plants have received EU renewable fuels of nonbiological origin (RFNBO) certification, paving the way for clean molecule exports. Price indications suggest Chinese players will sell at about \$600per metric ton of ammonia FOB—about double the gray ammonia but competitive in Europe's tight market. Prices should fall as first-of-a-kind challenges ease.

Renewables oversupply creates pressure on power sector margins and utilization. Green hydrogen offers a strategic outlet: Converting excess electricity into molecules enables China to "move electrons" from northern provinces to other markets. To support this, China is investing heavily in hydrogen pipelines and port facilities for ammonia and methanol exports.

The global hydrogen revolution has, so far, not materialized. But it is clearly emerging in the world's largest consumer of energy.

S&P Global Energy Horizons China's green H2 Horizons Top Trends 2026 December 2025

## China is deploying more electrolyzer capacity than the rest of the world combined



Credit: Content Design Source: S&P Global Energy





## Global SAF capacity expands by one third in 2026; Asia leads, Europe pays

Horizons data show aviation accounts for about 3% of global energy-related CO2 emissions. Air travel has rebounded strongly after the COVID-19 dip, and continued growth is projected. Many airlines have pledged to reach net-zero carbon emissions, and current decarbonization efforts focus on reducing the carbon intensity of existing fuels, scaling up use of SAF, enhancing aircraft efficiency and utilizing carbon offsets.

SAF growth will continue in 2026, but the pace slows. Global dedicated SAF capacity is expected to rise by about one third to 8 MMt; a strong increase but below the near-doubling seen annually from 2022 to 2025. The SAF market is still very small, at less than 0.5% of global jet fuel consumption.

## SAF demand vs dedicated capacity by region



**3%** in 2025

S&P Global Energy data show

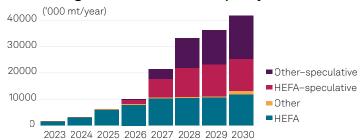
aviation accounted for about 3%

of global energy-related CO2 emissions

in 2025.

The industry is responding to trends in SAF consumption, which has surged since the start of the decade. The year 2025 was particularly strong, with SAF mandates introduced in the EU and the UK boosting demand. S&P Global Energy estimates that SAF consumption more than doubled in 2025 to reach 2 million metric tons (MMt). In contrast, growth in 2026 will be less pronounced as EU targets remain unchanged and policy shifts in the US make SAF production less attractive.

## Announced global dedicated SAF capacity



(ATJ-SPK). Capacity is based on publicly announced projects Kerosene (PTL-SPK), Fischer-Tropsch Synthetic Paraffinic Kerosene (FT-SPK); Alcohol-to-Jet Synthetic Paraffinic Kerosene. HEFA = Hydroprocessed Esters and Fatty Acids; Others include Power-to-Liquids Synthetic Paraffinic Source: S&P Global Energy

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Investments are accelerating in Asia, where producers benefit from lower production costs and abundant feedstock supplies, particularly used cooking oil (UCO). More than half of global SAF capacity will be concentrated in Asia in 2026, even though regional demand remains modest. Asian producers are targeting the European market, which is forecast to face a supply shortfall and where willingness to pay is high.

Beyond 2026, investments in SAF plants could accelerate sharply, with capacity potentially increasing eightfold to 42 MMt by 2030 if all announced projects materialize. Most projects are in North America (15.8 MMt), Asia (13.4 MMt) and Europe (7.2 MMt). However, only 7.3 MMt of capacity has

reached a final investment decision, leaving 28.5 MMt still awaiting approval.

Today, SAF is produced mainly via the commercially mature and cost-effective hydroprocessed esters and fatty acids (HEFA) pathway. One third of announced projects by 2030 plan to use newer technologies such as alcohol-to-jet (ATJ), gasification + Fischer-Tropsch (FT), methanol-to-jet (MTJ) and others. These face structural headwinds: technical challenges with integrating early-stage processes, high capital expenditure and production costs, reliable feedstock supply chains, and demand and price uncertainty. Overcoming these hurdles will be key to scaling up capacity if SAF is to remain a critical lever for decarbonizing aviation.



## Global EV sales surge

## China shows that EVs can be price-competitive with conventional ICE vehicles

Global EV sales appear set to climb further in 2026. Yet, as in years past, adoption rates are likely to be uneven among key markets. An examination of world EV adoption begins and ends with China. Owing to the large size of China's vehicle market and its relatively large EV share, about two out of every three light EVs sold globally in 2025 are estimated to have been sold in China. Further, China is increasingly "exporting" EV price deflation to the rest of the world.

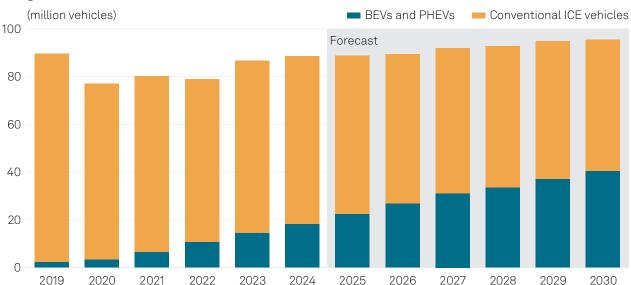
In 2025, China accounted for nearly

## two-thirds

of global light EV sales.

China appears on track for the full-year 2025 to become the first major "EV majority" new sales market globally — with battery-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) representing about 50% of new light vehicle (LV) sales in the first three quarters of the year. This is because EVs in China have, generally speaking, reached price parity with conventional

## Global new light vehicle sales



Note: As of November 2025 Source: S&P Global Energy S&P Global Energy Horizons Global EV sales surge Horizons Top Trends 2026 December 2025

internal combustion engine (ICE) vehicles, spurred by intense competition among automakers and suppliers. With EVs price-competitive with conventional ICE vehicles, China's EV share is set to keep rising in the years ahead as public chargers become more ubiquitous — and faster — reducing the "cost of inconvenience" of driving an EV.

In Europe, after two years of stagnation, the EV market is showing signs of life in 2025. A key reason is a step-up in the stringency of EU CO2 standards. Automakers in Europe have brought new EV models to market and offered discounts to consumers to help meet the tighter standards. Looking ahead, the prospect of tighter EU CO2 regulations in 2030 and 2035 — even if potentially looser than what is currently in place — together with intensifying competition from Chinese automakers, is likely to spur the region's current market leaders to develop and price competitively new BEV models, supporting EV adoption.

As for the US, in 2025, domestic EV policy once again swung sharply, with the federal government undoing support for EVs — both "carrots" and "sticks." The year 2026 will be the first in the modern EV era in which federal EV tax credits are not available to US consumers. The US auto industry is now undergoing a test of the strength of "organic" consumer demand. One trend that bears watching is how automakers position their EVs in a post-subsidy world as they move beyond the early adopter market.

The rest of the world is a diverse grouping, and thus EV adoption will vary widely from market to market. A common variable, though, will be the extent to which policy constrains imports of Chinese EVs and localized production, with more open markets experiencing a tailwind. Recent analysis by S&P Global Energy suggested that Thailand, Indonesia, Pakistan, Mexico, Nigeria and Malaysia are among the emerging market economies relatively ripe for the adoption of Chinese EVs.

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## Aligning carbon standards

## Global trade and climate policy is increasingly focused on harmonizing emissions reporting

What are GHG emissions? When it comes to corporate reporting, the definition can and often does differ. Early efforts to standardize emissions reporting were designed to be flexible so that they could apply across sectors. This intentional flexibility, however, has resulted in differences in how emissions are quantified and reported, limiting its utility.

There is growing consensus that inconsistencies in product-level carbon accounting need to be addressed, and harmonization is a prerequisite for the market to differentiate products based on carbon intensity. The Sustainable Business COP, which was launched ahead of the 30th Conference of the Parties (COP30),

featured carbon accounting as a key issue, with a new industry association, Carbon Measures, looking to accelerate the rollout of more robust product-level carbon accounting. Meanwhile, major revisions are being proposed for the world's leading emissions accounting standard — the GHG Protocol — to align reporting with current market realities. Changes in Scope 2 treatment can have wide-ranging implications for corporate choices to address power emissions. In 2026, carbon accounting is expected to heat up as a high-profile topic.

Potential proliferation of regulations like the EU Carbon Border Adjustment Mechanism (CBAM) require companies to report different emissions to different regulators, complicating trade. The CBAM will take effect on Jan. 1, 2026, requiring accountability for the carbon intensity of goods imported into Europe, even as key policy elements will only be finalized at the 11th hour. Key countries around the world are introducing their own emissions pricing systems, which would lessen the impact. Among key policy questions is: Will the EU introduce export rebates to reimburse carbon costs for EU products to boost their competitiveness on global markets? Some of the EU's major trading partners pushed back on CBAM at COP30. Criticism made it into the final COP Presidency report, promising more debate to come.

## Common sources of carbon accounting methodology differences



## System boundaries

- GHG estimators may choose (for perfectly justifiable reasons) different boundaries, stages and exclusions
- Guidance and alignment around direct emissions is generally good, but not universal
- Choices around some indirect emissions are a source of inconsistency

Source: S&P Global Energy



## Co-products

- Some processes (e.g., refining) can result in many diverse co-products
- Different choices are being made around excluding certain co-products between **GHG** estimates



## **Units**

- Best practices suggests reporting should consider units appropriate to each
- Even within the same sector, different units are being used
- Normalizing between units is often not possible, which limits comparability



### Quality

- Nearly all greenhouse gas data are estimates, which then vary in quality and often in composition
- Presently it is impossible to compare estimates based on quality, leading unfair comparisons, and large discrepancies in data quality between companies and regions

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## Energy geopolitics evolve

## China leverages global clean energy leadership as US influence wanes

The strategic energy divide between China and the US will widen in 2026. China has consolidated its leadership in clean energy technologies and supply chains, reinforcing its influence through state-led industrial policy and active climate diplomacy. China's cleantech overcapacity and weakening domestic demand make the export of cleantech products an economic imperative and a tool for geopolitical power projection.

The US, meanwhile, is prioritizing fossil fuel exports. However, this approach depends on stable trade relationships at a time when tariff measures and shifting trade policies add complexity to global energy markets. These dynamics may influence how emerging economies weigh their options between fossil fuels and clean technologies. China's offering aligns more closely with long-term climate strategies, even as export controls on rare earth elements highlight supply chain vulnerabilities.

Global financial flows in the energy sector reflect this trend. Spending in cleantech grows by nearly 30% over the next five years, while upstream spending remains roughly constant in real terms. The majority of new spending is moving East.

Washington is adopting a more interventionist industrial strategy. Expect greater government involvement through equity stakes, price floors for critical minerals and targeted support for technologies such as nuclear and advanced geothermal. This marks a significant shift from the US' historic model of funding early-stage innovation and letting markets pick winners and losers. A more interventionist approach provides clear signals for private capital as to which sectors and companies are favored.

30% increase

in cleantech spending over the next

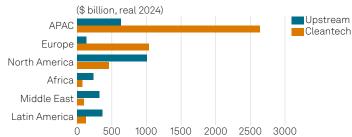
five years, with most of it moving East.

However, it also introduces new questions about competitive dynamics and the conditions for government backing.

Meanwhile, surging AI-driven electricity demand is accelerating an energy expansion mindset, echoing China's decades-long linkage of energy policy with national security.

Diplomatically, the contrast remains sharp. China continues to position itself as an active participant in climate negotiations, building on its role since the Paris Agreement and having recently released new emissions targets. The U.S., by comparison, has taken a more selective approach—skipping COP30 and challenging multilateral efforts such as International Maritime Organisation (IMO) shipping emissions pricing—creating space for China to expand its influence.

## Spending by region, 2025-30



As of September 2025. Cleantech supply spending - includes renewable power generation, green hydrogen production and carbon capture and storage (CCS) Source: S&P Global Energy

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# Adaptation gap

With emissions potentially driving a 2.3-degree-C temperature rise by 2040, adaptation shifts from optional to essential in 2026

Extreme weather and climate hazards are creating on-ground risks for infrastructure, physical assets and the companies that operate them. The global average temperature from January to August 2025 was 1.4 degrees C above preindustrial levels — just short of the Paris Agreement's 1.5-degree-C limit — and Horizons climate scientists estimate that there is a 50% likelihood of it exceeding 2.3 degrees C by 2040. A warmer, more volatile climate means extreme heat, drought, tropical cyclones and other hazards are likely to become more common and more severe and will incur heavy costs.

These hazards are already posing challenges to communities and industries. A historic drought in Iran has led to the prospect of water rationing in Tehran and the near depletion of hydropower capacity. Soaring summer heat across Europe — where temperatures are expected to rise faster than in many other regions — is driving rapid adoption of air conditioning, stretching electric grids in countries where per-capita electricity consumption has been much lower than in the US.

The cumulative economic effects of climate hazards — lost revenue from business interruption, repairs to physical damage and reduced employee productivity — translate into rising

About

## \$885B annual costs at risk

The increasingly urgent question is no longer

whether companies will adapt, but how —

and how quickly.

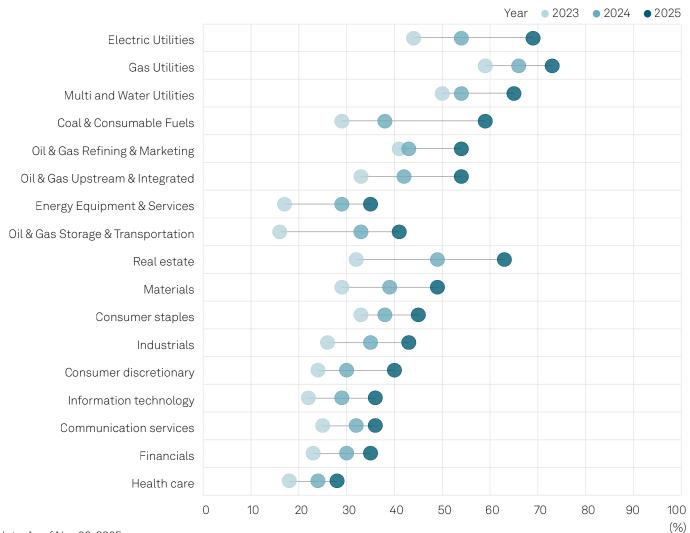
financial costs for companies. Given the observed trajectory of climate change, these costs will increase alongside physical risks. The Horizons Physical Risk dataset projects annual costs of about \$885 billion in aggregate for large publicly traded companies in the 2030s.

Climate risk assessments and physical risk adaptation planning are critical for resilience. Yet uptake across sectors remains patchy, according to data collected in the S&P Global CSA. Industries historically under greater climate scrutiny, and with operational exposure such as electric utilities, grid operators, and oil and gas companies, show the highest rates of risk assessment and adaptation planning. In other parts of the global economy, risk assessment and adaptation planning remain the exception rather than the rule.

S&P Global Energy Horizons Adaptation gap Horizons Top Trends 2026 December 2025

## Climate risk adaptation planning is building steam but remains rare in some industries and sectors

Percentage of companies by industry or sector that have a climate physical risk adaptation plan



Note: As of Nov 26, 2025 Source: S&P Global Energy

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## What's next?

In 2026, Al-driven load growth, grid bottlenecks, cleantech market fragmentation and geopolitics, evolving energy procurement strategies and carbon accounting, and rising physical climate risk will redefine the terms of progress. China's dominant position across cleantech supply chains — from solar and storage to green hydrogen and EVs — drives deployment but also generates new risks and will be a key factor in shaping the outcome of the China-US AI race.



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